

**Amendments to the Drawings:**

The attached replacement drawing sheets include changes to FIGS. 1-10, 16 and 17, where FIGS. 1-9 have been amended to indicate that they constitute --Prior Art--, and FIGS. 10, 16 and 17 have been amended to change the terms “equaliser”, “pre-equaliser”, “equalised”, “centre” and “symmetrisation” to “equalizer”, “pre-equalizer”, “equalized”, “center” and “symmetrization”, where appropriate.

## **REMARKS**

### **Claims Status**

Applicants acknowledge, with appreciation, the indication that claims 10 and 11 contain allowable subjected matter. Claims 1 and 3-13 are now pending, with claims 1 and 9 being the independent claims. Dependent claim 2 has been canceled. Claims 1 and 3-13 have been amended. Claim 1 has been amended to incorporate the features of canceled dependent claim 2. Dependent claim 13 has been added. No new matter has been added. Reconsideration of the application, as amended, is respectfully requested.

### **Overview of the Office Action**

The drawings have been objected to for certain informalities. Withdrawal of this objection is now in order.

The Specification has also been objected to for certain informalities. Withdrawal of this objection is also now in order.

Claims 6-8 and 12 have been objected to for being in improper form. Claims 1-5 and 9-11 have also been objected to for certain informalities. Withdrawal of these objections is also in order, as explained below.

Claim 9 stands rejected under 35 U.S.C. §112, first paragraph for being overly broad. Withdrawal of this rejection is also now in order, as explained below.

Claims 1, 2, 5 and 9 stand rejected under 35 U.S.C. §103(a) as obvious over “Correction of the Voice Timbre Distortions on Telephone Network” (“*Mahé*”) in view of U.S. Patent No. 5,895,447 (“*Ittycheriah*”), while claims 3 and 5 stand rejected under 35 U.S.C. §103(a) as obvious over *Mahé* in view of *Ittycheriah*, and further in view of U.S. Patent No. 4,310,721

(“*Manley*”). Lastly, claims 4, 5 and 11 stand rejected under 35 U.S.C. §103(a) as obvious over *Mahé* in view of *Ittycheriah*, and further in view of U.S. Patent No. 5,123,048 (“*Miyame*”).

Applicants have carefully considered the Examiner’s rejection, and the comments provided in support thereof, and respectfully disagree with the Examiner’s analysis. For the reasons which follow, it is respectfully submitted that all claims of the present application are patentable over the cited art.

#### **Amendments Addressing Formalities**

The Examiner has stated that “the spelling of equalisation, centre, symmertisation and other forms thereof, should be corrected to -equalization--, --center--”, etc. The Examiner has also stated that “Figures 1-9 should be labeled by a legend such as --Prior Art--”. In response to these objections to the drawings, Applicants submit herewith replacement sheets containing revised FIGS. 1-10, 16 and 17 that have been amended in the required manner. Entry of the replacement sheets is respectfully requested.

The Examiner has stated that claims 6-8 and 12 are improper in form. In response to these objections, applicants have amended claims 6-8 and 12 to variously depend from independent claims 1 or 9. Accordingly, withdrawal of this objection is deemed appropriate.

The Examiner has stated that claims “1-5 and 9-11 are replete with antecedent basis issues”. In response to each specific objection, Applicants have amended claims 1 and 3-11 in a manner which is believed to be self-explanatory. Accordingly, withdrawal of these objections is also appropriate.

### **Descriptive Summary of the Prior Art**

*Mahé* relates to a method for the correction of the voice timbre distortions on a telephone network.

*Ittycheriah* A method and apparatus for reducing computational overhead and storage requirements in speech and speaker recognition systems applied to a large speaker population (see col. 3, lines 2-5).

*Manley* relates to “a vocoder modem system having a digital signal processor which implements a Fourier transform (FFT) algorithm used for both vocoder and modem processing in both the transmit and receive modes” (see col. 2, lines 49-53).

*Miyame* relates to “a speech processing apparatus which is capable of extracting at high speed the speech of at least one particular talker from the aural signals containing the speech of a plurality of talkers” (see col. 2, lines 10-15).

### **Summary of the Subject Matter Disclosed in the Specification**

The following descriptive details are based on the specification. They are provided only for the convenience of the Examiner as part of the discussion presented herein, and are not intended to argue limitations which are unclaimed.

The claimed invention is directed to a method and system for improving the correction of voice timbre by reducing the approximation error in the original long-term spectrum of human speakers. In accordance with the invention, the speakers are classified according to their long-term spectrum and approximated, not by a single reference spectrum (UIT), but by one reference spectrum per class.

Thus, in accordance with the system and method of the invention, it becomes possible to perform equalization processing that is able to determine the class of the human speaker and to perform the equalization according to the reference spectrum of the class. As a result, a lower level of smoothing of the frequency response of the adapted equalizer is required due to the reduction in the approximation error, which makes it possible to correct finer spectral distortions.

#### **Patentability of Independent Claim 9 under 35 U.S.C. §112, First Paragraph**

The Examiner has stated that claim 9 lacks additional means for enabling the operations that the processing means performs. In particular, the Examiner has indicated that claim 9 is a single means claim. In response to this rejection, Applicants have amended independent claim 9 to recite “the system comprising: a digital filter and means for processing the voice signal...”. Accordingly, claim 9 as now amended is no longer in single means form and, therefore, complies with the requirements of 35 U.S.C. §112, first paragraph. Reconsideration and withdrawal of the rejection are therefore in order.

#### **Patentability of Independent Claims under 35 U.S.C. §103(a)**

The Examiner (pg. 6 thru 7 of the Office Action) acknowledges that *Mahé* fails to teach or suggest “the use of a generic spectral average based on a class to which a speaker belongs,” as recited in independent claim 1, and cites *Ittycheriah* for this feature. The combination of *Mahé* and *Ittycheriah*, however, fails to achieve Applicants’ claimed method as recited in now amended independent claim 1.

*Ittycheriah* discloses a method that includes classification of a speaker to perform speech recognition. In the speech recognition method disclosed in *Ittycheriah*, it is necessary to perform

training, and to then build a speaker dependent model for a small number of users. Such conventional recognition methods require many computational steps and a large amount of storage memory space to compute and store each model for a large speaker population.

The method disclosed in *Ittycheriah* is thus directed to reducing the number of models by using speaker classes to thereby reduce computational overhead and memory requirements. In order to accomplish this reduction, the method of *Ittycheriah* includes an arrangement for clustering information values representing respective frames of utterances of a plurality of speakers by speaker class, in accordance with a threshold value to provide speaker class specific clusters of information. *Ittycheriah's* method includes an arrangement for clustering information values -- representing respective frames of utterances of a plurality of speakers by speaker class in accordance with a threshold value -- to provide speaker class specific clusters of information. (see col. 3, lines 17-21).

However, *Ittycheriah* fails to teach or suggest that a speaker's classification is configured for use in correcting voice spectral deformations introduced by a communication network. A speech recognition system must be able to recognize identical words that are pronounced by different speakers. Difficulties associated with recognizing words or utterances are due to the difference of the speakers' voices. As a result, the method disclosed in *Ittycheriah* must classify the speakers from code words and codebooks that are built after voice training is performed to solve this problem.

*Mahé* teaches the approximation of the original long-term spectrum of speakers using the mean spectrum of the speech defined by the UIT to correct voice timbre distortions in a telephone network. More specifically, *Mahé* teaches the combination of a fixed equalization called pre-equalization with an equalization adapted to the real analog channel, which will be

placed after the pre-equalizer in the transmission chain to correcting such voice timbre distortions. Consequently, in the *Mahé* system the timbre of a voice is corrected by combining two filters.

The method disclosed in *Mahé* provides a way to restore a voice timbre close to that of the original signal on the equalization band ( $F_c$  - 3150 Hz). However, unlike the method recited in now amended claim 1, in the method of *Mahé*, for some speakers, the approximation of their original long-term spectrum via the reference spectrum is highly inaccurate. As a result, the equalizer introduces a perceptible distortion in the voice. In addition, the high smoothing of the frequency response of the equalizer, made necessary by the approximation error, prevents fine spectral distortions from being corrected. The claimed invention is directed to solving this problem associated with the approximation error in the original long-term spectrum of the speaker.

As stated previously, *Ittycheriah* teaches the classification of speakers in a recognition speech system to reduce computational overhead and memory requirements. A deformation of speaker's voices introduced by various links in a network transmission chain in the *Ittycheriah* system does not occur. Therefore, there is no reason for the skilled person to consider the teachings of *Ittycheriah* to modify the method of *Mahé* so as to achieve the method recited in now amended independent claim 1. Consequently, *Ittycheriah* fails to teach or suggests anything whatsoever with respect to classifying speakers according to their long-term spectrum. Moreover, *Ittycheriah* fails to teach or suggest that the constitution of classes of speakers comprises selecting a corpus of N speakers recorded under non-degraded conditions and determining the long-term frequency spectrum of the selected corpus of N speakers, as recited in now amended independent claim 1. *Ittycheriah* also fails to teach or suggest that the classes of

speakers further comprises classifying the speakers in the corpus according to their partial cepstrum, i.e., the cepstrum calculated from the long-term spectrum restricted to the equalization band and applying a predefined classification criterion to these cepstra in order to obtain classes, as recited in independent claim 1. Finally, there is nothing in *Ittycheriah* with respect to the calculation of the reference spectrum associated with each class in order to obtain a voice reference corresponding to each of the classes, as also recited in now amended independent claim 1.

In view of the foregoing, amended independent claim 1 is patentable over the combination of *Mahé* and *Ittycheriah* for at least this basis, because *Ittycheriah* fails to provide what *Mahé* lacks. Withdrawal of the rejection under 35 U.S.C. §103(a) is therefore requested, and a notice to that effect is earnestly solicited.

Independent claim 9 is the system in which the method of independent method claim 1 is implemented. Accordingly, independent system claim 9 is patentable over the combination of *Mahé* and *Ittycheriah* for the reasons discussed above with respect to independent method claim 1.

#### **Patentability of the Dependent Claims over the Prior Art under 35 U.S.C. 103**

The Examiner cites *Manley* in an attempt to cure the shortcomings of the combination of *Mahé* and *Ittycheriah*, i.e., “performing a Fourier transform on a cepstrum to obtain spectrum data” as recited in dependent claim 3. However, *Manley* fails to cure the deficiency of the method achieved by the combination of *Mahé* and *Ittycheriah*, because *Manley* fails to teach or suggest anything whatsoever with respect to correcting spectral deformations in a voice as



defined by now amended independent claim 1. Therefore, dependent claim 3 is patentable based on its dependency on independent claim 1.

The Examiner cites *Miyame* in an attempt to cure the shortcomings of the combination of *Mahé* and *Ittycheriah*, i.e., “speaker classification based on a mean pitch” as recited in dependent claim 4. However, *Miyame* fails to cure the deficiency of the method achieved by the combination of *Mahé* and *Ittycheriah*, because *Miyame* also fails to teach or suggest anything whatsoever with respect to correcting spectral deformations in a voice as defined by now amended independent claim 1. Therefore, dependent claim 4 is patentable based on its dependency on independent claim 1.

In view of the patentability of independent claims 1 and 9, for the reasons presented above, each of dependent claims 3-8, 10 and 11, as well as new dependent claim 13, is patentable therewith over the prior art. Moreover, each of these claims includes features which serve to even more clearly distinguish the invention over the applied references.

### **Conclusion**

Based on all of the above, it is respectfully submitted that the present application is now in proper condition for allowance. Prompt and favorable action to this effect and early passing of this application to issue are respectfully solicited.

Should the Examiner have any comments, questions, suggestions or objections, the Examiner is respectfully requested to telephone the undersigned in order to facilitate reaching a resolution of any outstanding issues.

It is believed that no fees or charges are required at this time in connection with the present application. However, if any fees or charges are required at this time, they may be charged to our Patent and Trademark Office Deposit Account No. 03-2412.

Respectfully submitted,  
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